

## CLAIMS

We claim:

1. A ceramic circuit structure having a plurality of ceramic layers and at least one electronic component embedded within the plurality of ceramic layers, wherein a first one of the ceramic layers comprises:

a through-hole that passes through the first ceramic layer, the through-hole being filled with a first electrically conductive material, which forms a via;

a contact pad formed on a surface of the first ceramic layer, the contact pad formed from a second electrically conductive material that is different from the first electrically conductive material;

a barrier cap formed in contact with and between the via and the contact pad, the barrier cap being formed from a third electrically conductive material that is different from the first and second electrically conductive materials; and

a dielectric ring covering a peripheral portion of the contact pad and an adjacent portion of the dielectric material layer surface immediately surrounding the contact pad, such that any solder that is applied to the contact does not contact the peripheral portion of the contact pad or the ceramic material.

2. A ceramic circuit structure as recited in claim 1 wherein the barrier cap prevents the first electrically conductive material within the through-hole from making contact with the second electrically conductive material forming the contact pad.

3. A ceramic circuit structure as recited in claim 1 wherein the ring of dielectric material is formed of glass.

4. A ceramic circuit structure as recited in claim 1 wherein the ring of dielectric material is partially embedded within the surface of the first ceramic layer.

5. A ceramic circuit structure as recited in claim 1 wherein the ceramic circuit structure is mounted onto a printed circuit board, and wherein the first ceramic layer of the plurality of ceramic layers is directly adjacent to the printed circuit board.

6. A ceramic circuit structure as recited in claim 1 wherein the contact pad is embedded within the surface of the first ceramic layer such that a surface of the contact pad is flush with the surface of the first ceramic layer.

7. A ceramic circuit structure as recited in claim 1 wherein the first electrically conductive material filling the through-hole is palladium-silver, the second electrically conductive material forming the contact pad is platinum-gold, and the third electrically conductive material forming the barrier cap is gold.

8. A ceramic circuit structure having a plurality of ceramic layers and at least one electronic component embedded within the plurality of ceramic layers, wherein a first one of the ceramic layers comprises:

a through-hole that passes through the first ceramic layer, the through-hole being filled with a first electrically conductive material, which forms a via;

a catch pad formed at one end of the via;

a contact pad formed on a surface of the first ceramic layer, the contact pad formed from a second electrically conductive material that is different from the first electrically conductive material; and

a barrier cap formed in contact with and between the catch pad and the contact pad, the barrier cap being formed from a third electrically conductive material that is different from the first and second electrically conductive materials.

9. A ceramic circuit structure having as recited in claim 8 further comprising:

a dielectric ring covering a peripheral portion of the contact pad and an adjacent portion of the dielectric material layer surface immediately surrounding the contact pad, such that any solder that is applied to the contact does not contact the peripheral portion of the contact pad or the ceramic material.

10. A ceramic circuit structure as recited in claim 8 wherein the barrier cap prevents the first electrically conductive material within the through-hole from chemically reacting with the second electrically conductive material forming the contact pad.

11. A ceramic circuit structure as recited in claim 9 wherein the ring of dielectric material is formed of glass.

12. A ceramic circuit structure as recited in claim 8 wherein the ceramic circuit structure is mounted onto a printed circuit board, and wherein the first ceramic layer of the plurality of ceramic layers is directly adjacent to the printed circuit board.

13. A ceramic circuit structure as recited in claim 8 wherein the contact pad is embedded within the surface of the first ceramic layer such that a surface of the contact pad is flush with the surface of the first ceramic layer.

14. A ceramic circuit structure as recited in claim 8 wherein the first electrically conductive material filling the through-hole is palladium-silver, the second electrically conductive material forming the contact pad is platinum-gold, and the third electrically conductive material forming the barrier cap is gold.

15. A ceramic circuit structure having a plurality of ceramic layers and at least one electronic component embedded within the plurality of ceramic layers, wherein a first one of the ceramic layers comprises:

a through-hole that passes through the first ceramic layer, the through-hole being filled with a first electrically conductive material, which forms a via;

a contact pad formed on a surface of the first ceramic layer, the contact pad formed from a second electrically conductive material that is different from the first electrically conductive material; and

a dielectric ring covering a peripheral portion of the contact pad and an adjacent portion of the dielectric material layer surface immediately surrounding the contact pad, such that any solder that is applied to the contact does not contact the peripheral portion of the contact pad or the ceramic material.

16. A ceramic circuit structure as recited in claim 15 wherein the ring of dielectric material is formed of glass.

17. A ceramic circuit structure as recited in claim 15 wherein the ring of dielectric material is partially embedded within the surface of the first ceramic layer.

18. A ceramic circuit structure as recited in claim 15 wherein the ceramic circuit structure is mounted onto a printed circuit board, and wherein the first ceramic layer of the plurality of ceramic layers is directly adjacent to the printed circuit board.

19. A ceramic circuit structure as recited in claim 15 wherein the contact pad is embedded within the surface of the first ceramic layer such that a surface of the contact pad is flush with the surface of the first ceramic layer.

20. A method for manufacturing a ceramic circuit structure having a plurality of ceramic layers, wherein at least one of the ceramic layers includes a plurality of vias therein and at least one electronic component formed thereon, the method comprising:

filling at least a portion of each of a plurality of through-holes, in at least one of the plurality of ceramic layers, with a first electrically conductive via material to form a plurality of electrically conductive vias;

forming a barrier cap at one end of each of the vias by depositing an electrically conductive barrier cap material on the respective ends of the vias, the barrier cap material being different from the via material;

forming a contact pad by depositing an electrically conductive contact pad material on a surface of at least one of the ceramic layers, the contact pad being in electrical contact with the barrier cap, the barrier cap serving to prevent contact between

the via and contact pad materials, the contact pad material being different from the via and barrier cap materials;

aligning each of the plurality of ceramic material layers on top of each other in a stack;

co-firing the stacked ceramic material layers.

21. A method for manufacturing a ceramic circuit structure as recited in claim 20 further comprising:

forming a dielectric ring such that the dielectric ring covers the perimeter of the contact pad and a portion of the ceramic material layer adjacent to the perimeter of the contact pad.

22. A method for manufacturing a ceramic circuit structure as recited in claim 21 wherein the ring of dielectric material is formed of glass.

23. A method for manufacturing a ceramic circuit structure as recited in claim 20 wherein the contact pad is embedded within the surface of a ceramic layer such that a surface of the contact pad is flush with the surface of the ceramic layer.

24. A method for manufacturing a ceramic circuit structure as recited in claim 20 wherein the via material filling the through-hole is palladium-silver, the contact pad material is platinum-gold, and the barrier cap material is gold.